Version 1 – 7 June 2009

A Workshop as Part of a Scoping Study to Define a Field Campaign on the Vulnerability and Resiliency of Arctic and Sub-Arctic Landscapes (VuRSAL) – The Role of Interactions between Climate, Permafrost, Hydrology, and Disturbance in Driving Ecosystem Processes

International Arctic Research Center
University of Alaska – Fairbanks
Fairbanks, Alaska
10 to 13 August 2009

WORKSHOP ORGANIZATION

We plan to focus the scoping study/workshop on four areas (numbered 1-4 in Figure 1). The scoping study/workshop will first focus on identifying the key research questions in each of the four study areas. These research questions will then be reviewed in the context of key ecosystem/landscape types found in the sub-arctic and arctic (e.g., forest, peatlands/wetlands/lakes, shrublands/tundra, and permafrost-impacted landscapes). We will then focus on determining what types of research and data are needed to address the questions, including discussions of field-based research, use of remote sensing, and modeling. Finally, we will consider the types of information systems that are needed to enable the research as well as provide information to key users and stakeholders.

The four primary areas to be considered by the workshop include (see Figure 1):

Area 1. The direct impacts of climate change on terrestrial ecosystems in sub-arctic and arctic regions.

This area will focus on direct responses of ecosystems to climate change, including variations in seasonal phenology and vegetation productivity, net ecosystem production, heterotrophic respiration, stress-related mortality, and migration of shrubs and trees.

Area 2. The indirect impacts of climate change on key forcing processes and associated effects on the environment and/or ecosystems.

Recent climate warming and shifts in the patterns of precipitation and snowfall in this region not only have a direct impact on ecosystem structure and function, but also have indirect impacts through controls on a number of important forcing processes, such as disturbance regimes (fire and insects), changes to surface hydrology (in particular lakes, wetlands and peatlands), and changes in the depth of thaw (the active layer). In addition, climate change has most likely changed important characteristics of these forcing factors, for example, changes to the seasonal patterns, frequency and severity of fires. Thus, understanding and developing approaches to monitor the impacts of climate on these forcing processes and their interactions is important because they, in turn, can have a direct impact on ecosystem properties and structure as well as drive changes to soil

moisture, temperature, permafrost thaw, and regulation of the patterns of lakes, wetlands, peatland inundation or drying.

Area 3. Interactive responses of ecosystems to changes in forcing processes and climate

Many of the forcing processes described above result in significant changes to the local environment (e.g., permafrost melting resulting in thermokarst) or to ecosystem structure (e.g., forest disturbance and succession changes from insects and fire). While many of these forcing processes have been present in arctic and sub-arctic regions for some time, in many instances, the nature of the forcing process may be changing as well. For instance, as noted above, the seasonal timing, frequency or severity of fires may be changing in response to a warming climate, which often affects ecosystems independent of climate change. Thus, an important area of discussion includes ecosystem responses to the combined direct and indirect impacts of climate (see figure).

Area 4. Feedbacks of ecosystem changes to climate and forcing processes

Finally, there are several important feedbacks to the climate that result from changes in sub-arctic and arctic ecosystems. Feedbacks to the climate include energy exchange (e.g. through surface albedo changes and associated impacts to atmospheric radiative forcing), carbon exchange between the atmosphere and terrestrial ecosystems (e.g. changes in vegetation productivity and ecosystem respiration, and associated impacts to atmospheric CO_2 concentrations), and water exchange between ecosystems and the atmosphere (e.g. changes in vegetation cover, land-atmosphere water and energy exchange and associated impacts to precipitation and runoff). There are a number of feedbacks to the forcing processes as well. For instance, a change in post-fire succession that involves a shift from coniferous to deciduous forest may impact vegetation flammability and result in a longer fire return interval. This shift will also change the vulnerability to future insect/disease outbreaks. Variations in depth of burning of surface organic layers have important feedbacks to the soil warming and permafrost.

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WORKSHOP SCHEDULE AND AGENDA

SUNDAY: 9 AUGUST 2009

8 am to 4 pm: Pre-workshop Field Trips – Delta Junction, Alaska – Impacts of fire severity on black spruce forests

MONDAY: 10 AUGUST 2009

9-12 Workshop Overview

Welcome and Introductions
Review of Scoping Study Goals
Review of Existing and Future Satellite Remote Sensing Systems
Review of Questions/Issues to be Considered during the Workshop

12-1 Lunch (provided by workshop organizers)

1-5 Breakout Session 1

4 breakout groups, one for each of the following areas (larger groups may sub-divide into two smaller groups)

1. The direct impacts of climate change on terrestrial ecosystems in sub-arctic and arctic regions
2. The indirect impacts of climate change on key forcing processes and associated effects on the environment and/or ecosystems
3. Interactive responses of ecosystems to changes in forcing processes and climate
4. Feedbacks of ecosystem changes to climate and forcing processes

Breakout Session 1 Objective: Review, discuss, and develop language for research issues and questions that should be addressed by the proposed field campaign in each of the 4 areas, including setting of the priorities for these issues and questions. Note the research issues and questions should not only include the earth system processes that are driving changes, but also the critical ecosystem services that are provided by Arctic and sub-Arctic ecosystems

TUESDAY: AUGUST 2009

8-930 Breakout Session 1 Reports and Discussion

930-12 Breakout Session 2 – Review and Refinement of Research Questions

The breakout groups will be organized by the primary ecosystems and landscape features found in the arctic and sub-arctic region, including: Tundra, peatlands/wetlands, lakes/ponds, forests, and frozen ground.

Breakout Session 2 Objective: Review, discuss and further refine the research issues and questions from a landscape/ecosystem perspective

12-1 Lunch (provided by workshop organizers)

1-2 Breakout Session 2 Reports and Discussion

2-5 Breakout Session 3 – Data, Observations, and Models Required to Address Issues and Questions

The same groups used for Session 2 will be used:

Breakout Session 3 Objective: Identify the improvements to models and the data and observations that are needed to address the research issues and questions identified in Breakout Sessions 1 and 2.

WEDNESDAY: 12 AUGUST 2009

8-930 Breakout Session 3 Reports and Discussion

930-12 Breakout Session 4: Strawman Experimental Plan

The same groups used for Session 1 will be used:

Breakout Session 4 Objective: Develop a strawman experimental plan to collect the data sets needed to both further develop and refine models and to address the research questions and issues or provi. The strawman experimental plan should determine the interdisciplinary skills needed to address the research questions, define the role that remotely-sensed data plays in addressing these questions, and identify ongoing or planned research and monitoring programs/activities that will provide the foundation for an international, interagency field campaign.

12-5 Optional field trips

THURSDAY: 13 AUGUST 2009

8-930 Breakout Session 4 Reports and Discussion

930-12 Breakout Session 5: Refinement of Strawman Experimental Plan

For this session, we will use the same groups that were used during Breakout Session 2.

Breakout Session 4 Objective: Review and refine the plans in the context of each research area, with attention being paid to how the plans mesh with ongoing or planned future research activities.

12-1 Lunch (provided by workshop organizers)

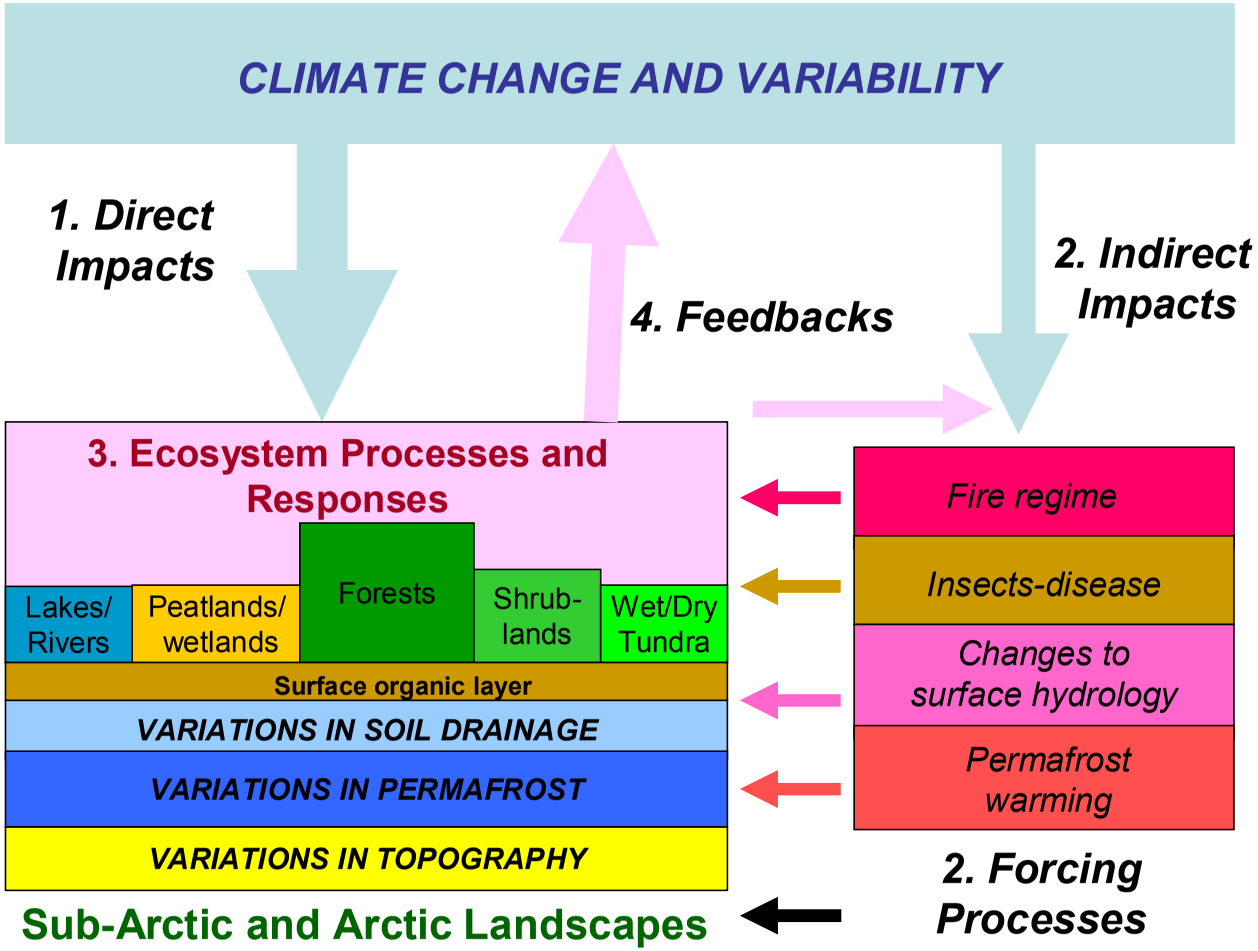
1-2 Breakout Session 5 Reports

2-430 Breakout Session 6 – Data and Information System Requirements

The groups for this breakout session will be the same used for Breakout Session 2

Breakout Session 6 Objective: Review and discuss requirements and recommendations for the data and information system that would be required to support the field campaign and provide information to managers, decision makers, and stakeholders.

430-530 Breakout Session 6 Reports


CLIMATE CHANGE AND VARIABILITY
1. Direct Impacts
4. Feedbacks
2. Indirect Impacts
3. Ecosystem Processes and Responses
Lakes/ Rivers
Peatlands/ wetlands
Forests
Shrub-lands
Wet/Dry Tundra
Surface organic layer
VARIATIONS IN SOIL DRAINAGE
VARIATIONS IN PERMAFROST
VARIATIONS IN TOPOGRAPHY
Sub-Arctic and Arctic Landscapes
Fire regime
Insects-disease
Changes to surface hydrology
Permafrost warming
2. Forcing Processes